

## Fossil Energy Technologies

**T**he Fossil Energy Department applies scientific and engineering principles to convert raw hydrocarbon materials to refined energy products while minimizing economic, safety and environmental impacts. The group consists of scientists and engineers trained in petroleum engineering, mechanical engineering, geophysics and chemical engineering. It has a solid reputation in scientific and industrial communities due to its nationally and internationally recognized staff—including INL Fellows, R&D 100 award winners, adjunct university faculty and committee chairs and members of national and international journals and scientific organizations. Many staff have extensive industrial experience.

### Capabilities

These capabilities are combined with numerous (~40) other scientific and engineering skills to support over fifty current fossil energy research and subsurface science projects at INL. The main thrusts of our Fossil Energy Department are: Exploration and Production, Reservoir and Environmental Technologies, Oil & Gas Sensors and Controls, Natural Gas, Oil/Gas and Coal Processing, and Hydrogen for National Energy missions.

**Our Exploration and Production** group conducts research to provide solutions to industry-identified problems related to oil and gas exploration, production and transportation. Projects include research on locating geo-pressured hydrocarbon reservoirs, locating and characterizing methane hydrates deposits (reservoir modeling, geophysical logging tools, and thermogenic/biogenic sources of methane hydrates) and transportation of hydrocarbon indicators in the Four Corners region.

**Our Reservoir and Environ-**

**mental Technologies** group conducts research that characterizes oil, gas, and coal reservoirs, how they can be efficiently produced and how the depleted reservoirs can be used for sequestration purposes. For example, we evaluate possible health risks related to naturally occurring radioactive materials (NORM) that are commonly encountered in oil production facilities. We are developing technologies to treat such environmental problems as accumulations of benzene, toluene, ethylene and xylene (BTEX) in the vadose zone. Simple low-cost bioreactors are being developed for treating produced water and gas in oil field and offshore platform environments for removal of sulfides. Several projects to physically or biologically capture CO<sub>2</sub> from flue gas and then to sequester the CO<sub>2</sub> in geological repositories are underway. Projects to evaluate the environmental impact of water produced from coal bed methane have also started.

**Our Oil & Gas Sensors and Control** group conducts research to provide solutions

to a number of industry-identified problems that relate to downhole instrumentation. Projects include research on a downhole seismic source for look-ahead prediction, a high void fraction multiphase meter, large downhole seismic sensor arrays, oil and gas production sensors and controls, and single well seismic imaging. Research projects seek to transfer oil and gas technology to the characterization and treatment of sub-surface science environmental contamination problems.

**Our Natural Gas** group focuses on liquefied natural gas (LNG) and compressed natural gas (CNG) as alternatives to conventional gasoline and diesel fuels for powering heavy-duty and light-duty vehicles. The major current thrust is to develop and demonstrate technologies to reduce the capital and operating costs associated with producing LNG by a factor of 10, while simultaneously doing gas clean-up and reducing capital and operating costs associated with C/LNG

*Continued on back*

Science



*Continued from front*

fueling stations — by a factor of 10. The group is focused on developing and installing the infrastructure (pipes, fueling stations, vehicles) to use C/LNG in urban “Clean Cities” and in regional national parks.

Our **Oil & Gas, and Coal Processing** group conducts studies and experimental evaluations of new technologies to improve the efficiency, economics, and environmental acceptability of the conversion of oil, gas, and coal to refined hydrocarbon products and electrical power. Because of the decreasing quality of crude oil being produced worldwide, we explore novel approaches for treating petroleum to enable refineries to process these lower-grade materials, with reduced energy costs and environmental liabilities. We also research gas to liquids processes to produce environmentally clean liquid fuels. A major thrust in this area is to transfer an excess DOE coal plant to industry where it will simultaneously produce electricity and serve as a test bed for clean coal technologies.

Our **Hydrogen** group conducts research to develop and commercialize technologies related to production, infrastructure, and use of hydrogen fuel. Current projects include reforming diesel fuel to make hydrogen, reforming natural gas to make hydrogen, using nuclear power to reform water into hydrogen, studying development of new carriers for hydrogen use, and aug-

mentation of engines—including fuel cells—to use hydrogen.

Fossil Energy is a group that links many of INL’s core competencies and capabilities into a crosscutting multidisciplinary team to solve energy and energy infrastructure related problems. The Department is actively evaluating potential areas including — supporting the development of technologies to drill for oil and gas in the ultra-deep waters of the Gulf of Mexico. And, the development of technologies associated with Vision 21 and Clean Coal Power Initiative programs, support for expanded access to federal lands in the western U.S. for the exploration and production of oil and gas and technologies to efficiently capture stranded gas for transport to end-users.

The following categories of research associations illustrate the variety of activities our group conducts and performs, including:

#### Upstream Exploration and Production

Enhanced oil recovery, CO<sub>2</sub> capture technologies, coal bed methane, methane hydrate characterization and production

#### Oil, Gas and Coal Processing

Coal plant transfer, clean coal gas clean up, clean coal power systems demonstrations, gas (hydrogen and oxygen) separations, catalyst regeneration, bio-uplifting of oil, biomass gasification

#### Reservoir and

Environmental Technologies  
Geological CO<sub>2</sub> sequestration, probabilistic risk assessment

#### Oil and Gas Sensors and Controls

Advanced seismic sources and sensors for oil and gas, seismic sensors for environmental contamination, seismic imaging systems

#### Hydrogen

Reforming of hydrocarbons, reforming of water, alternate storage solutions, fuel cells.

#### **For more information**

**Bruce Reynolds**  
*Manager*  
*Fossil Energy Department*  
*208-526-1992*  
*Bruce.Reynolds@inl.gov*

INL is a U.S. Department of  
Energy national laboratory  
operated by Battelle Energy  
Alliance

